

First record of *Mesoscytina* (Hemiptera, Scytinopteroidea, Scytinopteridae) from the Middle Triassic Tongchuan Entomofauna of China

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Abstract

A new scytinopterid species, *Mesoscytina tongchuanensis* **sp. nov.**, is established based on a tegmen collected from the Middle Triassic Tongchuan Formation in Shaanxi Province, NW China. The new species can be easily separated from its congeners by the narrow tegminal apex, less curved terminal branches of stems RP, M and CuA and crossvein *r-m* connected to long vein M_{1+2} . This discovery represents the first record of *Mesoscytina* from the Tongchuan Formation in China and suggests that the genus *Mesoscytina* spread much more widely from Gondwana to northern Pangea in the Middle Triassic.

Key words: Ladinian, *Mesoscytina tongchuanensis* sp. nov., new record, Scytinopteridae, systematics, taxonomy, Tongchuan Formation



Academic editor: Nina Sinichenkova

Received: 27 August 2024

Accepted: 19 October 2024

Published: 27 November 2024

ZooBank: <https://zoobank.org/72BBDAA4-2F13-4E09-BCF5-C52FB4C81A93>

Citation: Zhang Q, Du X, Zhu X, Zhang H (2024) First record of *Mesoscytina* (Hemiptera, Scytinopteroidea, Scytinopteridae) from the Middle Triassic Tongchuan Entomofauna of China. ZooKeys 1219: 99–104. <https://doi.org/10.3897/zookeys.1219.135654>

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Introduction

The family Scytinopteridae Handlirsch, 1906, an extinct Permian-Triassic hemipteran group widespread in Pangea, is characterized by the costal fracture on the heavily sclerotized punctate tegmen and a hypocostal socket fixed on the thorax (Shcherbakov 1984). Moreover, the basal cell shape, single *r-m* crossvein, very weak or absent nodal groove and vein M bent strongly towards CuA are important common characters among Triassic scytinopterid taxa (Lambkin 2016). As ancestors of true bugs, the scytinopteroids are supposed to inhabit temporary submerged waterside vegetation (Shcherbakov 2022). The taxonomic study of Scytinopteridae is of both evolutionary and ecological significance.

The genus *Mesoscytina* Tillyard, 1919 was originally assigned to Scytinopteridae, then to the cercopoid family Archijassidae Becker-Migdisova, 1962 (Hamilton 1992). Lambkin (2016) re-assigned *Mesoscytina* to Scytinopteridae, re-studied the four species of *Mesoscytina* and further proposed the genus *Triassoscarta* being synonymous with *Mesoscytina*. Lara et al. (2021) established the new combination *Mesoscytina forsterae* (Martins-Neto & Gallego,

2003) (Martins-Neto et al. 2003). Here, we describe a new *Mesoscytina* species from the Tongchuan Entomofauna, which is the fourth Triassic scytinopteroid species discovered in China (Lin 1986; Zhang et al. 2022).

Material and methods

The entire tegmen was collected from the Tongchuan Formation of Hejiafang Village, Jinsuoguan Town, Yintai District, Tongchuan City, Shaanxi Province, NW China. A U-Pb geochronology study confirms the insect-bearing layer is dated to 238–237 Ma, as Ladinian of the Middle Triassic (Zheng et al. 2018).

The holotype (NIGP205761) is housed at the Nanjing Institute of Geology and Palaeontology (**NIGPAS**), Chinese Academy of Sciences (**CAS**), Nanjing, China. Photographs were taken using a stereomicroscope system (ZEISS Stereo Discovery V16) in NIGPAS. Images of the part and counterpart of the tegmen were corrected and stacked using Adobe Photoshop 2021, and line drawings were made through software CorelDRAW 2019. The vein nomenclature follows Shcherbakov (1984, 1996). The nomenclatural acts established herein are registered under ZooBank LSID urn:lsid:zoobank.org:pub:72BB-DAA4-2F13-4E09-BCF5-C52FB4C81A93.

Systematic palaeontology

Order Hemiptera Linnaeus, 1758

Infraorder Cicadomorpha Evans, 1946

Superfamily Scytinopteroidea Handlirsch, 1906

Family Scytinopteridae Handlirsch, 1906

***Mesoscytina* Tillyard, 1919**

Type species. *Mesoscytina australis* Tillyard, 1919.

***Mesoscytina tongchuanensis* Q. Zhang, Du & H. Zhang, sp. nov.**

<https://zoobank.org/871B77B9-0162-476B-B3C9-EE1BA18F3D8A>

Figs 1, 2A

Type material. Holotype: No. NIGP205761a, b, an isolated complete tegmen, part and counterpart. Housed at NIGPAS. South of Hejifang Village, Jinsuoguan Town, Yintai District, Tongchuan City, Shaanxi Province, China.

Age and horizon. Ladinian, late Middle Triassic; top of the lower Tongchuan Formation.

Etymology. The specific epithet is from the city of Tongchuan, where the holotype was collected.

Diagnosis. Small tegmen (6–11 mm in length), punctate, quite broad (length/width ratio less than 2.5), broadest on its middle area, with apical area contracted; postcostal area wide; costal fracture curved and single; vein R with two terminal branches; stem M partly curved, with three terminal branches, vein M_{1+2} long; end of vein CuA_2 beyond vein CuP; terminal branches of stems RP, M and CuA not more or less parallel; crossvein *cua-cup* long, less curved veins

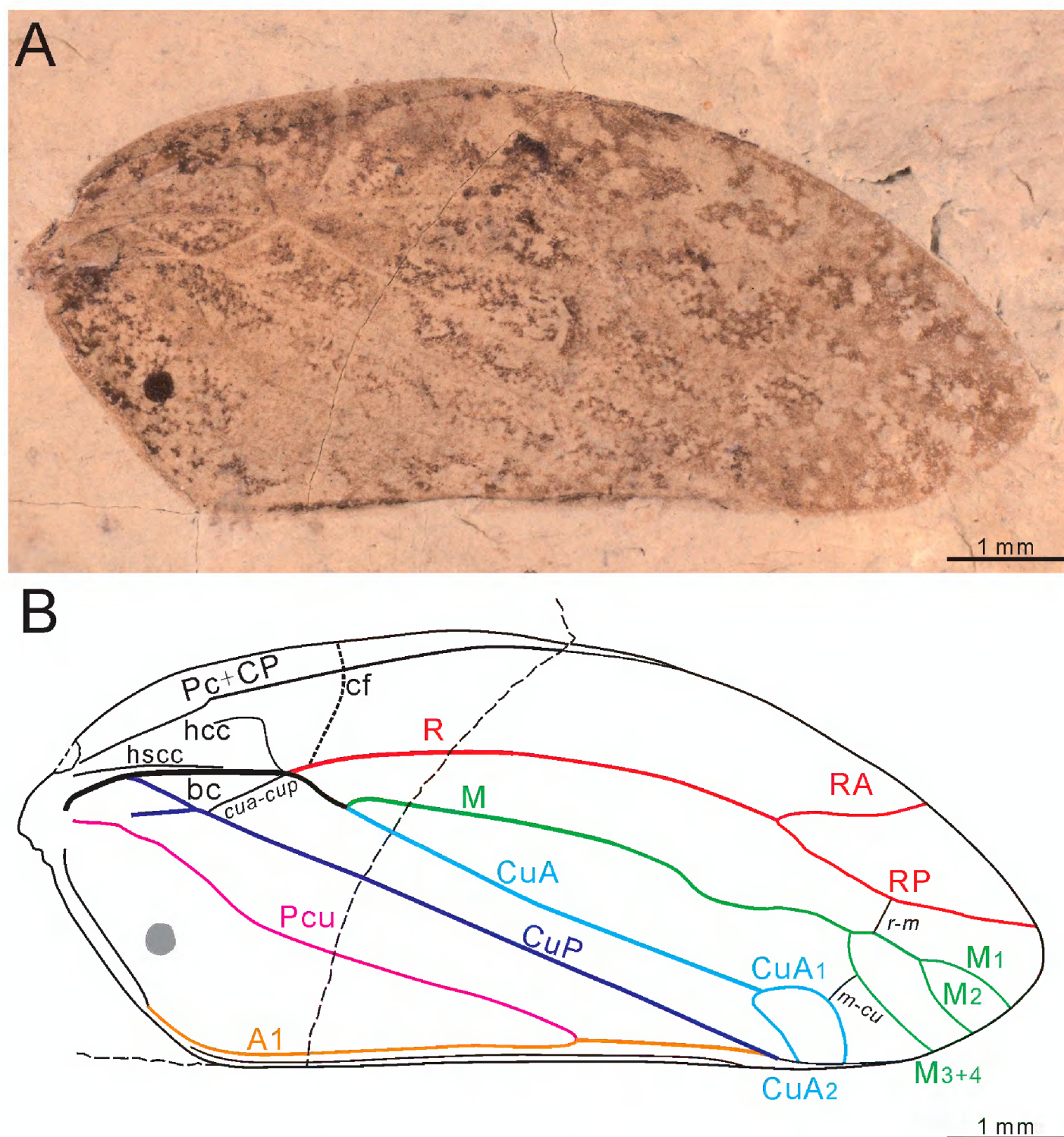


Figure 1. *Mesoscytina tongchuanensis* Q. Zhang, Du & H. Zhang, sp. nov., holotype (NIGP205761), tegmen **A** photograph **B** reconstruction and venation (granules ignored).

M_{3+4} and CuA_1 smoothly connected at crossvein *m-cu*. Clavus developed and convex, veins *Pcu* and *A1* forming a “Y” fork; color patterns small and irregular.

Description. Tegmen convex with clavus attached, punctate more distinct on basal tegmen surface. Tegmen length 8.9 mm, maximum width 3.75 mm, length/width ratio 2.37. Tegmen apex asymmetric, gradually narrowed posteriorly. Costa anterior strongly arched, posterior margin more or less straight; tegmen broadest near middle part. Vein *Pc+CP* curved and merged into anterior margin at basal 3/5 tegmen length. Costal area widest near basal cell; postcostal area much wider than costal area. Hypocostal carina sigmoid, merged into stem *R+M+CuA*, hyposubcostal carina straight, close to stem *R+M+CuA* gradually; costal fracture curved apically, originating from stem *R*, stretched crossvein *Pc+CP* vertically. Basal cell closed, nearly triangle in shape. Vein *R* slightly curved, first forked into veins *RA* and *RP* at apical 1/4 of tegmen length; vein *RA* shorter than vein *RP* in length; vein *RP* curved posteriorly. Stem *M+CuA* strong and short, bifurcated first near basal 1/3 of tegmen length. Vein *M* curved anteriorly first, extending straight on middle membrane, then strongly bent towards vein *CuA* before reaching level of stem *R* forking. Vein *M* first forked into veins M_{1+2} and M_{3+4} at apical 1/5 tegmen length; veins M_1 , M_2 and M_{3+4} single; crossvein *r-m* connected veins *RP* and M_{1+2} ; crossvein *m-cu* connected to evenly curved

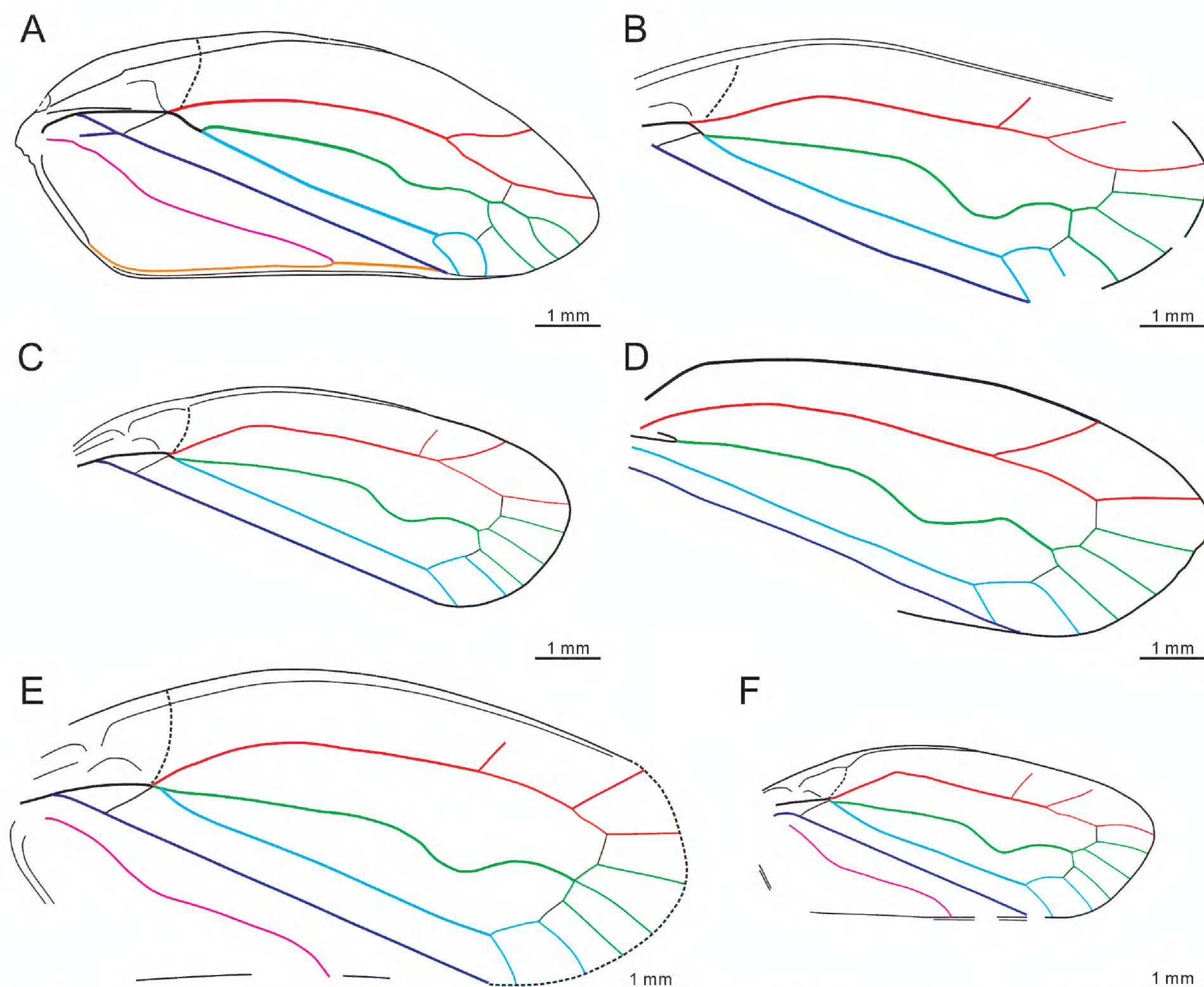


Figure 2. Comparison of tegminal venation in *Mesoscytina* Tillyard, 1919 **A** *M. tongchuanensis* Q. Zhang, Du & H. Zhang, sp. nov. **B** *M. australis* Tillyard, 1919 **C** *M. fistulae* Lambkin, 2016 **D** *M. forsterae* (Martins-Neto & Gallego) Lara et al. 2021 **E** *M. magna* Lambkin, 2016 **F** *M. woodsi* Lambkin, 2016.

M_{3+4} and CuA_1 . Vein CuA single and straight, extending in direction of stem $M+CuA$; vein CuA divided into veinlets CuA_1 and CuA_2 near same level of vein R fork; vein CuA_1 curved strongly towards posterior margin, vein CuA_2 shorter than vein CuA_1 , merely just extending beyond clavus apex. Vein CuP single, slightly curved basally before leaving basal cell, then extending straight towards clavus apex after connecting with long crossvein *cua-cup*. Clavus large and convex, with anal angle about 120° ; vein Pcu single, curved posteriorly, forming a “Y” fork with vein $A1$. Vein $A2$ close to $A1$, parallel with postclaval margin and merged before end level of vein CuP . Small, irregular, dark-colored patterns shown on tegmen.

Discussion

According to the key to genera of Scytinopteridae proposed by Zhang et al. (2022), the new species is placed within the genus *Mesoscytina* Tillyard, 1919 by the punctate tegmen, curved vein M , apically forked vein R and three terminal branches of vein M .

So far, there are only five species of *Mesoscytina* Tillyard, 1919 (*M. australis* Tillyard, 1919, *M. fistulae* Lambkin, 2016; *M. forsterae* (Martins-Neto & Gallego, 2003) Lara et al. 2021; *M. magna* Lambkin, 2016 and *M. woodsi* Lambkin, 2016) reported from the Triassic at Mount Crosby, Denmark Hill, Gayndah and Dinmore (Queensland, NE Australia) (Tillyard 1919; Lambkin 2016) and of Tongchuan (Shaanxi, NW China). The notable differences between *Mesoscytina tongchuanensis* Q. Zhang, Du et H. Zhang, sp. nov. and its congeners lie in a lower length/width ratio (at least 2.6 in its congeners), a much longer length of stem M_{1+2} , apical terminals of RP, M and CuA less parallel, crossvein *r-m* connected to vein M_{1+2} and the apical shape of the tegmen.

Specifically, the new species (Fig. 2A) roughly differentiates from *M. australis* Tillyard, 1919 (Fig. 2B) by a wider but shorter costal area, a narrower apex and less developed R branches. It can also be easily distinguished from *M. fistulae* (Fig. 2C) by the more curved branches of veins M and CuA; from *M. forsterae* (Fig. 2D) in the presence of a larger basal cell, and crossvein *r-m* connected to vein M_{1+2} (to M_1 in *M. forsterae*); from *M. magna* (Fig. 2E) by the shorter tegmen, the less developed areola postica (wider than medial area cells in *M. magna*), three M branches that forked twice (forked into three branches at the same level in *M. magna*); and from *M. woodsi* (Fig. 2F) in having a larger tegmen with base of vein R slightly curved (angulate at base in *M. woodsi*).

Conclusion

As the first record of *Mesoscytina* from the Middle Triassic Tongchuan Entomofauna in China, *M. tongchuanensis* Q. Zhang, Du & H. Zhang, sp. nov. is unique by its lateral narrowed apex, less curved terminal branches of stems RP, M and CuA and crossvein *r-m* connected to vein M_{1+2} . Its establishment not only extends the palaeogeographical record of *Mesoscytina* Tillyard, 1919 from Gondwana to northern Pangea supercontinents of the Northern Hemisphere in the Middle Triassic (Ladinian) but provides the most complete tegminal venation information (especially the clavus) in this genus to date.

Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

No ethical statement was reported.

Funding

This research is supported by the National Natural Science Foundation of China (42293280), the Fundamental Research Funds for the Liaoning Universities and the Shenyang Normal University (BS202209).

Author contributions

Funding acquisition: QZ, HZ. Investigation: XZ. Software: XD. Writing - original draft: QZ. Writing - review and editing: HZ, XD.

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Data availability

All of the data that support the findings of this study are available in the main text.

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